TO: L. Snow

From Jim McLeod
Bainta/Carbona Irrg Dist.

high-rate, direct filtration plant designed and operated to meet all drinking water quality requirements. The reservoirs could then be maintained in a relatively full condition for better response in times when Delta water quality might be deteriorated due to salinity intrusion and the capability to properly treat Delta water would be in place to provide full delivery during an aqueduct failure. Mixtures of Delta water and Pardee water could be a part of such an approach.

Is this technically feasible? Yes!

TREATMENT OF DELTA WATER

Both the Contra Costa Water Intake, which serves the Bollman Water Treatment plant, and the EBMUD Bixler Pumping station which could service a new EBMUD treatment plant should experience relatively similar water quality during periods of normal water flows in the rivers flowing into the Delta. Another potential source for EBMUD is at the point that the EBMUD Aqueduct crosses the Middle River. The Middle River is inferred to have higher quality water than the other points of Delta water diversion. In a previous drought, Middle River water was diverted to the Contra Costa Intake because of high chloride levels at their normal intake and was also used for some delivery to EBMUD.

In 1991, both EBMUD and the Contra Costa Water District published water quality data for their drinking water (CDWA Exs 1 and 2). The Contra Costa water was derived mainly from the Delta, whereas the EBMUD water was derived from the Pardee Reservoir. The data for both are included in Appendix C. Drawing from the tables in Appendix C-1 and C-3, we can tabulate the mean annual water quality as follows:

Standard	Water Quality Parameters	Contra Costa Treated Delta Water	EBMUD Treated Pardee Water	EPA MCL
Primary	Turbidity, NTU	0.07	0.06	0.5
Primary	Total coliform	0 (% positive)	0.19, #/100 mL	10% positive
Primary	THM, μg/L	70.	44.	100
Primary	Aluminum, mg/L	0.06	0.10	1.0
Primary	Fluoride, mg/L	1.0	0.72	1.4-2.4
Secondary	Chloride, mg/L	162	4.	500
Secondary	Copper, mg/L	0.005	0.003	1
Secondary	Zinc, mg/L	ND	0.004	5.0
Secondary	Iron, mg/L	ND-0.04	0.02	0.3
Secondary	Manganese, mg/L	0.002	0.002	
Secondary	Odor, TON	2	0	3
Secondary	Specific Conductance, μmohs/cm	808	93	1,600
Secondary	Sulfate, mg/L	64	7	500
Secondary	TDS, mg/L	442	65	1,000
	Total Hardness, mg/L	123	33	–
	pH, units	8.6	8.6	–
	Sodium, mg/L	104	4.6	

It should be noted that:

1. Both drinking waters meet <u>all</u> EPA/State drinking water standards.

2. Both the EBMUD and the Contra Costa District desire to <u>lower</u> the Total Trihalomethanes (THM's) present in their drinking water.

3. Although the Contra Costa District does not report a drinking water concentration for Nitrate, they do indicate the raw water range is between 1.2 and 4.2 mg/L., whereas the EPA MCL is 45 mg/L. EBMUD drinking water nitrate ranges from 0.23 to 1.35 mg/L.

EBMUD makes the point that EPA is considering the lowering of the THM Maximum Contaminant Level (MCL) from 100 to the range of 10 to 50 ug/L. During and following the Iowa State University - Bolton & Menk, Inc. study group visit to the Contra Costa County Water District plant (the Ralph D. Bollman Water Treatment Plant at Concord, CA), we were provided with two reports prepared by James M. Montgomery, Consulting Engineers, Inc. pertaining to pilot-plant and prototype demonstration studies:

Contra Costa Water District. Pre-Ozonation/Deep Bed Filtration, Pilot Plant Study, JMM, September 1986 (CDWA Ex 5)

Contra Costa Water District. Pre-Ozonation/Deep Bed Filtration, Prototype Demonstration Study, JMM, September 1988. (CDWA Ex 6)

The pilot plant study was conducted with five objectives:

"1. To evaluate ozone as a preoxidant with respect to chemical coagulant dose reduction, TOX/THMFP control and improved filter performance.

2. To evaluate the effectiveness of deep bed media filtration using GAC and anthracite in mono media and tri media beds for the treatment of Delta water.

3. To evaluate the removal of an organic compound on GAC which is exhausted with respect to humic substances.

4. To achieve the finished water turbidity goal of $\leq$0.1 NTU.

5. To produce superior quality water at a cost equal to or near conventional treatment."

After completion of a 16-month study, the Executive Summary in the report summary indicates that all of the five objectives were achieved, as shown in Appendix E. It is

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especially noteworthy that the high potential filter operating rate (10 gpm/sq ft) might be used to filter Delta water successfully.

As a result of the findings, JMM conducted a second study using a 200 gpm prototype water treatment facility to demonstrate the process train for the Contra Costa Water District and the California Department of Health Services. The letter of transmittal of the report (CDWA Ex 6) indicates that:

> "Results from this study have proven that the process train is a viable treatment alternative for Sacramento - San Joaquin Delta water. All current and anticipated potable water quality goals were achievable with this process."

The Executive Summary (Appendix D) includes a 4-page summary of the report, a summary of the conclusions of the report, and recommended design procedures for a full-scale plant.

In effect, the treatment process, which would also be applicable for use in a new EBMUD plant for filtration of Delta water, is a relatively simple direct filtration plant using pre-ozonation, alum and polymer for destabilization of the raw water suspended particulates in flocculators, and filtration at a design rate of 6 gpm/sq. ft. in granular activated carbon filters. The prototype plant schematic diagram is shown in Figure 2-1.

CONCLUSIONS

Let me summarize what I have concluded from my review based on 40 years of education and experience working in environmental engineering aspects of water and wastewater treatment:

1. EBMUD has two potential points for diversion of Delta waters into a modern technology water treatment plant.

   The Bixler pumping plant intake at Werner Dredge Cut (Indian Slough) now intended only for emergency use. This water is of similar quality to that entering the Contra Costa Water District Canal.

   The point where the EBMUD Aqueduct from the Pardee Reservoir crosses the Middle River. The water here is apparently of better quality than at the Bixler/CCD Canal, since it was used previously in the 1976-77 drought to supply water both to the EBMUD system and to dilute chloride levels entering the CCWD Canal.

It appears that the second Delta water intake would be preferred if the reliability of delivering this water to the service area can be assured during flood/earthquake periods.

2. The American Water Works Association Research Foundation Reports develop and demonstrate design and operating guidelines for high-rate water treatment plants. The pilot/prototype treatment plants operated by JMM on both Delta water and water from the EBMUD Aqueduct conclusively demonstrate that the pre-ozonation; flocculation, deep-bed direct-filtration process consistently produced a water that meets all applicable current and foreseeable drinking water standards. The use of pre-ozonation for organic oxidation produced a filtered water whose Total Trihalomethane (THM) content through filtration was 1 ug/L or less. (CDWA Ex 6, pgs. 4-17) In fact, with several final disinfection systems, the THM content of the finished water was always less than 8 ug/L.

   The cost of a plant of this type would produce water which meets all drinking water standards at costs less than or comparable to those envisioned in EBMUD planning.

3. The EBMUD planning involves use of Mokelumne River/-Pardee Reservoir water as long as it is available, resorting to use of Delta water only when reservoir storage is essentially exhausted. Thus, the current emphasis is on increasing storage by means of the proposed new Buckhorn Reservoir or the Los Vaqueros Reservoir. Eventually, the water demand in the EBMUD

service area will exceed the Mokelumne River watersheds ability to supply water to meet all needs, and the Districts ability to purchase outside water. Thus, use of Delta water becomes more and more imperative.

It would therefore be entirely technically feasible and cost effective to adopt a policy of building/operating a Delta treatment plant so as to be able to use Delta water on a continuous basis. In this manner, during periods of adequate supply from the Mokelumne River watershed, the surplus water would service the needs of the River below the Pardee Dam and maintain the Delta water of much better raw water quality. In times of drought, the regular use of Delta water could be adjusted as needed to maintain storage capacity while still sending water through the River to meet its quality/quantity needs. During periods of extreme drought, the reservoirs could then be used to supply water at increasing rates as Delta water was used at decreasing rates in such a way as to maintain sodium, chloride, and TDS levels at desirable levels by blending the two Delta/Aqueduct treated waters. In this manner, there should be no need for a reverse osmosis desalination plant operation during periods of severe drought. Such plants can, however, be technically and economically effective in producing low solids water using pretreated water from direct filtration plants of the type proposed for filtering Delta water.

4. The use of treated Delta water and mixtures of Delta water and Pardee Reservoir waters would reduce rather than add to the health risks in use of the water in the service area.